HAER No. NV-31

HAER
NEV
12-MERC.V,
5-

Nevada Test Site, Super Kukla Facility
Area 27, Rock Valley
South of Cane Spring Road
Mercury Vicinity
Nye County
Nevada

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
San Francisco, California

HAER
NEV
12-MERC. V,
5-

HISTORIC AMERICAN ENGINEERING RECORD
NEVADA TEST SITE, SUPER KUKLA FACILITY
HAER NO. NV-31

Location: Rock Valley, Area 27, Nevada Test Site, Mercury Vicinity, Nye County, Nevada

USGS Cane Spring (1986) and Skull Mountain (1983) 7.5'
UTM Coordinates Zone 11 E 578,075 N 4,070,830

Dates of Construction: Building 5400 in 1963 and Building 5400A in 1968

Engineer: Norman Engineering Company, Consulting Engineers, Los Angeles, California

Builder: Baldwin-Lima-Hamilton Company

Present Owner: Department of Energy, Nevada Operations Office
P.O. Box 98518, Las Vegas, NV 89193-8518

Present Occupant: Not occupied

Present Use: Vacant; no public access; to be demolished

Significance: The Super Kukla facility, housing a small prompt burst reactor, is significant for its role in the United States defense program at the Nevada Test Site during the 1960s and 1970s. It was employed to evaluate the response of components and materials used in nuclear explosive devices to neutron burst exposure prior to the actual testing of such devices.

Report Prepared by:
Harold Drollinger and Colleen M. Beck
Desert Research Institute
755 East Flamingo
Las Vegas, NV 89119

Nancy Goldenberg
Carey & Company, Inc., Architects
Old Engine Co., No. 2
460 Bush Street
San Francisco, CA 94108

Date: November 2000

I. CONTEXTUAL INFORMATION

The Super Kukla facility is located in a remote setting in Area 27 toward the southern part of the Nevada Test Site (NTS) operated by the Department of Energy, Nevada Operations Office (DOE/NV) (Figure 1). It is reached by traveling north from the town of Mercury along the Mercury Highway, over the Checkpoint Pass and into Frenchman Flat, turning west at the Cane Spring Road junction, and then proceeding to a paved turnoff to the south just past Cane Spring. Traveling south through a pass in Skull Mountain and entering the northern part of Rock Valley, a road to the west is reached that leads to the facility. The setting of the facility is at the northern extent of the Mohave Desert and at the north edge of Rock Valley and the south base and near the east end of Skull Mountain. Hampel Hill is to the southeast, Mount Sayer to the northeast, Frenchman Flat further east, and Jackass Flats to the west. Wahmonie Flat is just to the north of Skull Mountain. Elevation of the facility is 4,410 ft (1,344 m).

Surrounding vegetation is creosote bush (*Larrea tridentata*), bursage (*Ambrosia dumosa*), blackbrush (*Coleogyne ramosissima*), Mormon tea (*Ephedra nevadensis*), thornberry (*Lycium* sp.), and other shrubs, grasses, and cacti. In the area are kit fox, desert tortoise, western shovelnose snake, the sidewinder snake, speckled rattlesnake, gopher snake, coyote, bobcat, raven, red-tailed hawk, black-tailed jackrabbit, desert and Nuttall's cottontail, long-tailed pocket mouse, kangaroo rat, desert woodrat, white-tailed antelope squirrel, black-throated sparrow, horned lark, Say's phoebe, western kingbird, loggerhead shrike, chuckwalla, side-blotched lizard, and desert horned lizard. Other animals in the region include mountain lion, chukar, Gambel's quail, morning dove, golden eagle, and occasionally, bighorn sheep and antelope.

The Super Kukla facility spans about 350 x 250 ft (107 x 76 m), covering about 2 acres (0.4 hectares), and includes a corrugated metal High Bay (Building 5400A) mounted on top of a completely bermed Containment Building (Building 5400), and two smaller corrugated metal ancillary structures attached just south and east of the berm (Figures 2-3; Photographs NV-31-1 and NV-31-2). These are the Mechanical Building (Building 5410) and the Relay Building (Building 5420). A painted plywood structure stands to the southwest across the access road. A Control Building is located about half a mile to the southeast and is where all machine operations were conducted via closed circuit television (Gilbert et al. 1964:5). The Mechanical Building has a metal chimney to its north, similar to one at the north exterior of the High Bay. In the Mechanical Building was the power control and distribution equipment, the air conditioning system for the Containment Building, the hydraulic power unit, compressed nitrogen containers, and an air compressor (Gilbert et al. 1964:13). The Relay Building contained the electronic equipment. All equipment was able to be remotely operated from the Control Building. The north side of the High Bay features a concrete pad and an asphalt drive leading to a rolling metal door. A parking area was also established on the north side. Stairs ascend the berm on the south side between the ancillary structures, leading to a personnel door at the southwest corner of the high bay. A barbed wire fence surrounds the facility, much of which has fallen down, and an interior security fence with personnel gates surrounds the High Bay and Containment Building. The facility has been determined eligible to the National Register of Historic Places through consultation between DOE/NV and the Nevada State Historic Preservation Office and both buildings, 5400 and 5400A, are currently slated to be demolished under the Environmental Management Deactivation and Decommissioning Program (Carlson 1999).

II. ARCHITECTURAL AND ENGINEERING INFORMATION

The Super Kukla facility, housing an "all-metal prompt burst reactor" (Gilbert et al. 1964:1), was built in 1963 and in operation from 1964 to 1979. A metal high bay was added in 1968. Basic design and technical assistance in the construction of the reactor was by the Lawrence Radiation Laboratory, Livermore, California. It was built by the Baldwin-Lima-Hamilton Company (Gilbert et al. 1964:1). The engineer firm for the facility was Norman Engineering Company, Consulting Engineers, Los Angeles, California.

High Bay

The exterior of the tall rectangular High Bay is clad in corrugated aluminum and features a slightly pitched metal gable roof (Figures 4-6; Photographs NV-31-B-1 to NV-31-B-4). A personnel gate in the security fence is at the northeast side (Photograph NV-31-3). A low, small one-story shed attaches to the southeast corner and serves as a windbreak. An external tubular metal chimney stands centered, in front of the north elevation, apparently venting the space below. A tall, 18 ft (5.5 m) high by 10 ft (3 m) wide rolling metal door penetrates the western end of the north wall. Personnel doors access the building at both the northwest and southeast corners of the building. The remaining exterior walls are blank.

The interior features a concrete floor and smooth metal painted walls, with an exposed structural steel frame (Photographs NV-31-B-5 to NV-31-B-7). Dimensions of the building interior are 22.67 ft (6.9 m) wide by 41 ft (12 m) long, 25 ft (8 m) high at the lowest point. The north elevation (long side) features a tall rolling metal door at its west end, and a personnel door at its east end. An access ladder stands in the northwest corner. Electric meters mount to the south wall, with a second personnel door at its west end. The east end of the space features a metal floor grate, with the Super Kukla reactor stand at its center. East of the grate is a steel pipe column ascending approximately twelve feet. A roof hatch opens directly above the Super Kukla reactor stand. A seven-and-one-half ton crane mounts to the ceiling. White metal industrial lights hang from the ceiling.

Containment Building

The main structure at the facility was the Containment Building (Figures 7-8; Photographs NV-31-A-1 to NV-31-A-4), the lower building, built of concrete and covered with a minimum of four feet of earthen fill (Gilbert et al. 1964:6). Access was through a down-sloping tunnel at the west side, curved to prevent a line-of-site neutron path from the interior. Overall dimensions of the space are 40 ft and 8 inches (12.4 m) east-west by 20 ft (6 m) north-south, and 20 ft high. Walls are 14 inches (31 cm) thick, and the ceiling, 24 inches (60 cm) thick. The ceiling, now separating the containment area from the High Bay, was constructed of removable concrete panels so the reactor could be installed or removed. The interior of the Containment Building consists of a large rectangular concrete-encased room with an accessible pit or basement below. The floor slab between the pit and main space is a full 36 inches (90 cm) at its thickest point.

The rectangular upper room is divided into east and west rooms by a partial-height lead shielding wall 8 inches (20 cm) thick. This wall features horizontal grooves and a shielding window, and is mounted with instrumentation. The Manipulation Room or operator area is at the west end and features overhead pincers and a crane. The crane carried samples to be irradiated over the shielding wall and lowered them into the reactor (Gilbert et al 1964:11). Afterward, the crane was used to remove the samples by placing them in a lead cask and carrying them back over the shield wall (Gilbert et al 1964:12). A pair of master-slave manipulators allowed work to be remotely conducted in the other room from behind the lead shielding wall. Pipes and gauges mount to the north wall, while pipes and an electrical panel mount to the south. Special double blast doors, 4.5 inches thick, are at the west wall and exit is made through them and the tunnel to the surface. Stairs leading down to the pit are in the southwest corner. The easternmost room is the Machine Room or reactor area and at its center is a plastic-swathed housing for the reactor. The reactor, itself, has been removed. The ceiling above features a glazed or mirrored hatch, running continuously north-south and correlates with the metal grate in the high bay above. The northeast corner features a circular steel floor plate, approximately 2 ft in diameter. A duct mounts to the east wall.

Stairs from the Manipulation Room lead to the pit in the lower level. This space is a 12 ft (3.7 m) diameter cylinder with a rectangular antechamber at the south end. Centered in the cylinder is a 3 ft (0.9 m) diameter and 3 ft deep sump pit. The space is walled by corrugated metal and concrete with mounted panels, gauges, tanks, and a large-scale diffuser. Floor and ceiling are concrete slab. Equipment at the center of the room ascends from the sump pit, extending to a 3 ft diameter hole in the ceiling, centered beneath the reactor.

III. HISTORICAL INFORMATION

The first nuclear bomb, known as Trinity, was detonated in southern New Mexico on July 16, 1945. The next nuclear explosions were over Hiroshima and Nagasaki, Japan during

World War II, and shortly after the war, on Bikini and Enewetak atolls in the Marshall Islands of Micronesia (Friesen 1995:3; Ogle 1985:40-42). These latter islands became known as the Pacific Proving Grounds. The Atomic Energy Commission (now the U.S. Department of Energy) was also established soon after the war when President Truman signed the Atomic Energy Act of 1946. Research, development, and production of atomic weapons for the military was the primary mission (Anders 1978:2). Shortly thereafter, the making of nuclear weapons would become an industrialized process, with research being conducted at the Los Alamos Scientific Laboratory (now the Los Alamos National Laboratory), New Mexico and development and production at such places as Sandia (now the Sandia National Laboratories), New Mexico, the Y-12 Plant in Oak Ridge, Tennessee, at Hanford, Washington, and the Rock Island Arsenal in Illinois (Anders 1978:3; Stapp 1997). The former Soviet Union detonated its first nuclear device in 1949, resulting in an arms race with the United States and other countries for nuclear weapon superiority (Anders 1978:4; Ogle 1985:20). Following this event, increased efforts were implemented in the United States for research and development of nuclear weapons. A second weapons research laboratory was established at Livermore, California, that eventually became the Lawrence Livermore National Laboratory. Other major facilities included manufacturing plants at Rocky Flats near Golden, Colorado; the Kansas City Plant in Missouri; the Burlington Army Ordnance Plant in Iowa; the Pinellas Plant in Largo, Florida; Mound Laboratory in Miamsburg, Ohio; and the Pantex Plant near Amarillo, Texas (Anders 1978:4; Department of Energy 1997:27).

During the late 1940s a search was conducted to establish a test site in the continental United States relatively remote from the populace and near the research laboratories, particularly the one at Los Alamos, New Mexico. The main reasons for this were security, shorter travel times between the test area and the labs, and economic costs in transporting people and equipment between the test area and various facilities (Lay 1950; Ogle 1985:44; Tlachac 1991a). At the time, testing was conducted at the Pacific Proving Grounds and was relatively expensive in both costs and time. In addition, security in the Pacific locale was a major concern, being outside the confines of the United States. Four places in the United States were seriously considered for a continental testing ground: Camp Lejeune in North Carolina, Dugway Proving Ground in Utah, White Sands Proving Ground in New Mexico, and the Las Vegas Bombing and Gunnery Range in southern Nevada (Lay 1950). The ideal location was to have favorable and predictable weather and terrain conditions so as to be able to test year round, have a low human population because of radiological concerns, be under federal control, have an infrastructure in place, and be relatively close to the Los Alamos laboratory (Lay 1950; Tlachac 1991a). The best place meeting all these condition was in southern Nevada. Camp Lejeune was too far from the lab and did not have enough federally-controlled land, while Dugway and White Sands did not have the degree of radiological safety. The onset of the Korean War finally propelled the issue forward. The first land withdrawal by the Atomic Energy Commission (AEC) establishing an official testing ground in the United States for nuclear weapons in Nevada was February 12, 1952 under Public Land Order 805. Subsequent parcels were obtained under Public Land Orders 2568 and 3759 and by a Memorandum of Agreement between the U.S. Air Force and the AEC. The memorandum was superseded by a second one in 1982 between the Air Force and DOE/NV. Today, the NTS encompasses an area of 1,375 sq mi (3,561 sq km).

Although land for the NTS was not officially withdrawn until 1952 from the Las Vegas Bombing and Gunnery Range, construction of the facilities for the soon to be Nevada Proving Grounds began in 1951. The first nuclear weapon test at the new facility was carried out in Frenchman Flat on January 27, 1951 (Ogle 1985:43-44; Titus 1986:58). Between 1951 and 1958, numerous atmospheric nuclear weapons tests were conducted in Yucca and Frenchman flats on the NTS. These bombs were initially dropped from airplanes, but due to efforts for greater monitoring and a general lack of control from air drops, the devices were placed near the ground, on top of towers, and eventually elevated by balloons to the desired height. Also at this time in the Pacific arena, high altitude tests of large yield were being performed, mostly by balloon and a few on rockets (Ogle 1985:49-50). Other tests were placed on barges and underwater. One of the objectives to testing during this period, besides perfecting techniques and technological improvement of the weapon, was the effects on buildings, objects, animals and, in some cases, Army personnel and life-size mannequins for military as well as civil defense purposes (Ogle 1985:84-85). Some of the earliest experiments were to determine the effects on naval ships, while later experiments included effects on airplanes, tanks, jeeps, clothing, docks, different types of houses, underground structures, and radio and radar transmissions. Camp Desert Rock in the southeast portion of the NTS was used to bivouac U.S. Army troops whom participated in tactical training for atomic warfare and were directly exposed to atmospheric tests (Edwards 1997).

Both the United States and the former Soviet Union ceased nuclear testing in 1958 by self-imposed moratoriums at the urging of internal and external forces (Ogle 1985:30-31), but by 1961 both superpowers were once again conducting tests. Except for a few surface and near-surface tests, most of the tests after the moratorium were placed underground, and after ratification of the Limited Test Ban Treaty among the Unites States, the Soviet Union, and Great Britain in 1963 all tests were underground (Friesen 1995:6). According to the treaty, no tests could be carried out in the atmosphere, outer space, or underwater. Underground tests on the NTS between 1963 and 1992 would be conducted either in shafts or tunnels on Yucca and Frenchman flats and on Buckboard, Pahute, and Rainier mesas. A second moratorium on nuclear testing was established in 1992 and no nuclear tests have been conducted by the United States since that date. A total of 928 nuclear tests have been conducted on the NTS, with 120 performed in the 1950s and 808 after 1961 (DOE/NV 1994; Friesen 1995:6, 10).

Super Kukla Facility

Nuclear testing has been depicted as a major and important theme in the history of Nevada (Tlachac 1991a, 1991b). Most of this activity revolved around the NTS, highlighted by such facilities and sites as the town of Mercury, Camp Desert Rock, the Experimental Farm, the Nuclear Rocket Development Station, Doom Town, Japanese Village, Area 12 Support Facility, the Control Point, and Area 5 atmospheric testing structures (Tlachac 1991b). Nuclear testing also has an appeal on the national level as well, with the NTS having a vital role in the national defense of our country for the past fifty years and during the Cold War. It was at the NTS where most of the developments and experiments in nuclear weapons were actually tested, both above and below ground. The Super Kukla facility was active after the Limited Test Ban Treaty in 1963 when all nuclear weapons tests at the NTS were placed underground. Operated by LLNL, the purpose of the reactor was to irradiate "a wide variety of test specimens or samples, many of which include fissile materials" (Gilbert et al. 1964:1). Fissile materials refer to isotopes capable of being split or fissioned. Samples were components of nuclear devices and were tested at the facility for their response to neutron burst exposure. The reactor was housed in the underground Containment Building at the facility, and measured 30 inches (76 cm) in diameter, height about 37 inches (94 cm), and weighed about 5 tons (4.5 metric tons). Samples were placed either inside or outside of the reactor and reactivity control was maintained by six fuel rods which fit into the core of the reactor. The interior cavity was 18 inches (46 cm) in diameter. No personnel were allowed in the facility and all doors were closed when the reactor was operated. Furthermore, there was some concern about radioactive release into the atmosphere for the immediate area and special operating procedures were implemented to safeguard personnel (Gilbert 1964:37). As a security measure, access to the area was only by authorized persons. Currently, all reactor fuel rods have been removed, the reactor disassembled, and the facility has been in a standby status since 1979 when it was determined there was no longer a programmatic need for such tests.

IV. SOURCES

Anders, Roger M.
1978 *Institutional Origins of the Department of Energy*. Energy History Series 1(1), The Office of Military Application, Department of Energy, Washington, D.C.

Carlson, Kathleen A.
1999 *Selection of End Points for Deactivation and Decommissioning (D&D) Facilities at the Nevada Test Site (NTS)*. Manuscript on file, Department of Energy, Nevada Operations Office, Las Vegas.

Department of Energy
1997 *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to their Environmental Consequences*. Report No. DOE/EM-0319, Office of Environmental Management, U.S. Department of Energy, Washington, D.C.

Department of Energy, Nevada Operations Office (DOE/NV)
1994 *United States Nuclear Tests: July 1945 through September 1992*. Report No. DOE/NV-209 (Revision 14), National Technical Information Service, Springfield, Virginia.

Edwards, Susan R.
1997 *Atomic Age Training Camp: The Historical Archaeology of Camp Desert Rock*. M.A. thesis, Department of Anthropology and Ethnic Studies, University of Nevada, Las Vegas.

Friesen, H.N.
1995 *Radiological Effluents Released from Nuclear Rocket and Ramjet Engine Tests at the Nevada Test Site, 1959 through 1969*. Raytheon Services Nevada, Las Vegas. Report No. DOE/NV-401, Department of Energy, Nevada Operations Office, Las Vegas.

Gilbert, W.S., F.A. Kloverstrom, and F. Rienecker, Jr.
1964 *Revised Safety Analysis Report for the Super Kukla Prompt Burst Reactor*. Report No. UCRL-7695, Lawrence Radiation Laboratory, University of California, Livermore, California.

Lay, James S., Jr.
1950 Memorandum for the President from the National Security Council, December 18, 1950. Manuscript on file, Accession No. 304388, Coordination and Information Center, Department of Energy, Nevada Operations Office, Las Vegas.

Ogle, William E.
1985 *An Account of the Return to Nuclear Weapons Testing by the United States after the Test Moratorium 1958-1961*. U.S. Department of Energy, Nevada Operations Office, Las Vegas.

Stapp, Darby C.
1997 Documenting a Cold War Nuclear Reactor: Attempting Innovation. *CRM* 20(13):38-40.

Titus, A.C.
1986 *Bombs in the Backyard: Atomic Testing and American Politics*. University of Nevada Press, Reno.

Tlachac, Eve M.
1991a Nuclear Testing. In *Nevada Comprehensive Preservation Plan*, edited by White, W.G., R.M. James, and R. Bernstein, pp. 25/1-25/12. Division of Historic Preservation and Archaeology, Department of Conservation and Natural Resources, Nevada Historical Society, Department of Museums and History, Carson City, Nevada.

1991b Operating Plan. In *Nevada Comprehensive Preservation Plan*, edited by White, W.G., R.M. James, and R. Bernstein, pp. 25/13-25/24. Division of Historic Preservation and Archaeology, Department of Conservation and Natural Resources, Nevada Historical Society, Department of Museums and History, Carson City, Nevada.

V. PROJECT INFORMATION

This manuscript has been prepared at the request of the Department of Energy, Nevada Operations Office in response to the management of cultural resources on the Nevada Test Site. It is based on a previous investigation conducted by the Desert Research Institute, reported in Cultural Resources Reconnaissance Short Report No. SR021500-1, *An Historical Evaluation of the Super Kukla Facility in Area 27 for Activities Associated with the Decontamination and Decommissioning Program, Nevada Test Site, Nye County, Nevada*, 2000. Project Manager and Co-Principal Investigator for documentation of the facility was Colleen M. Beck of the Desert Research Institute, Las Vegas, Nevada; Harold Drollinger of the Desert Research Institute, Las Vegas was the second Principal Investigator; Nancy Goldenberg of Carey & Company, Inc. Architects, San Francisco, California was the historic architect; and the photographer was Richard Smith of Bechtel Nevada, Las Vegas.

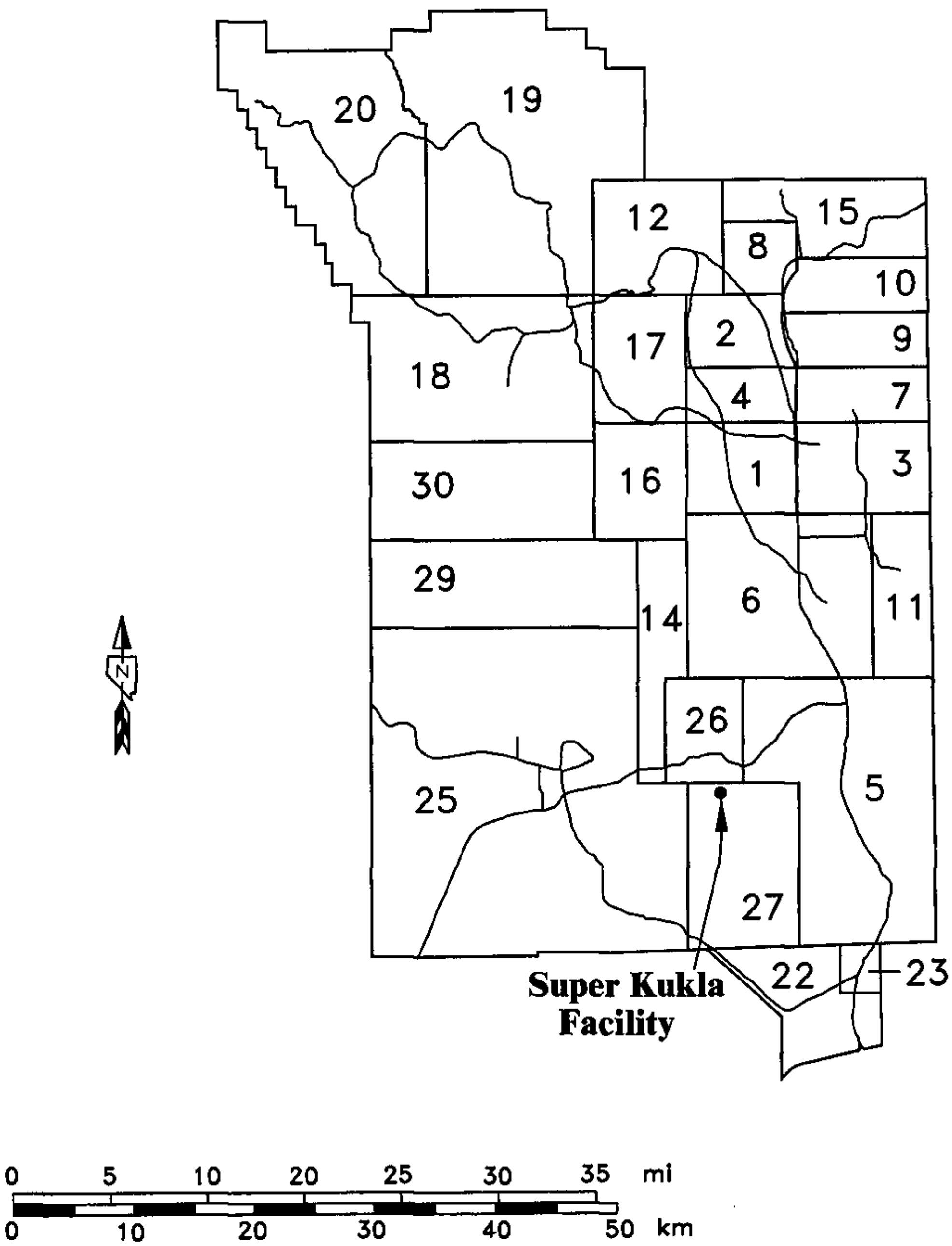

Figure 1. General location of the Super Kukla facility on the NTS.

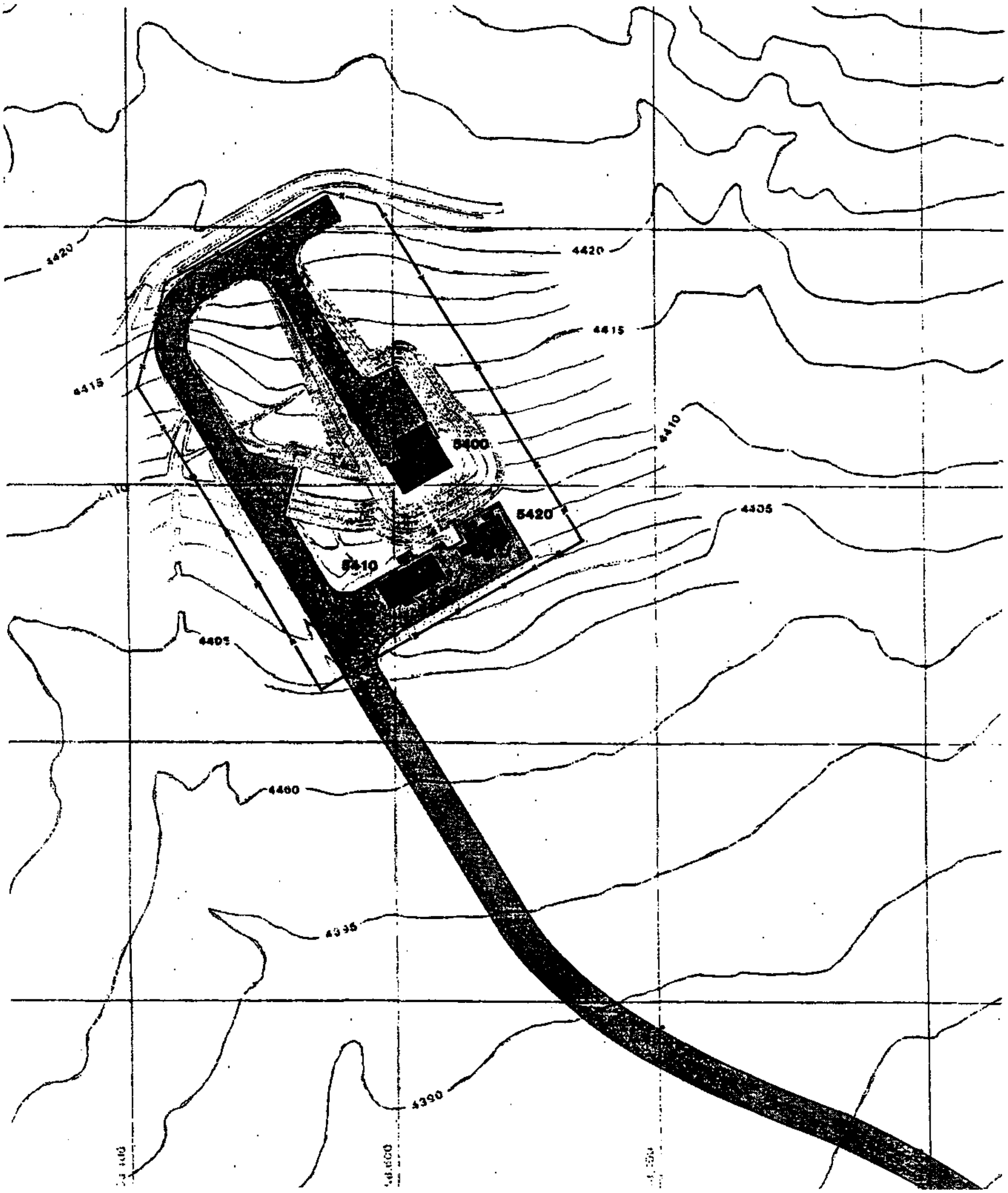

Figure 2. Plan map of the Super Kukla facility, ca. 1994.

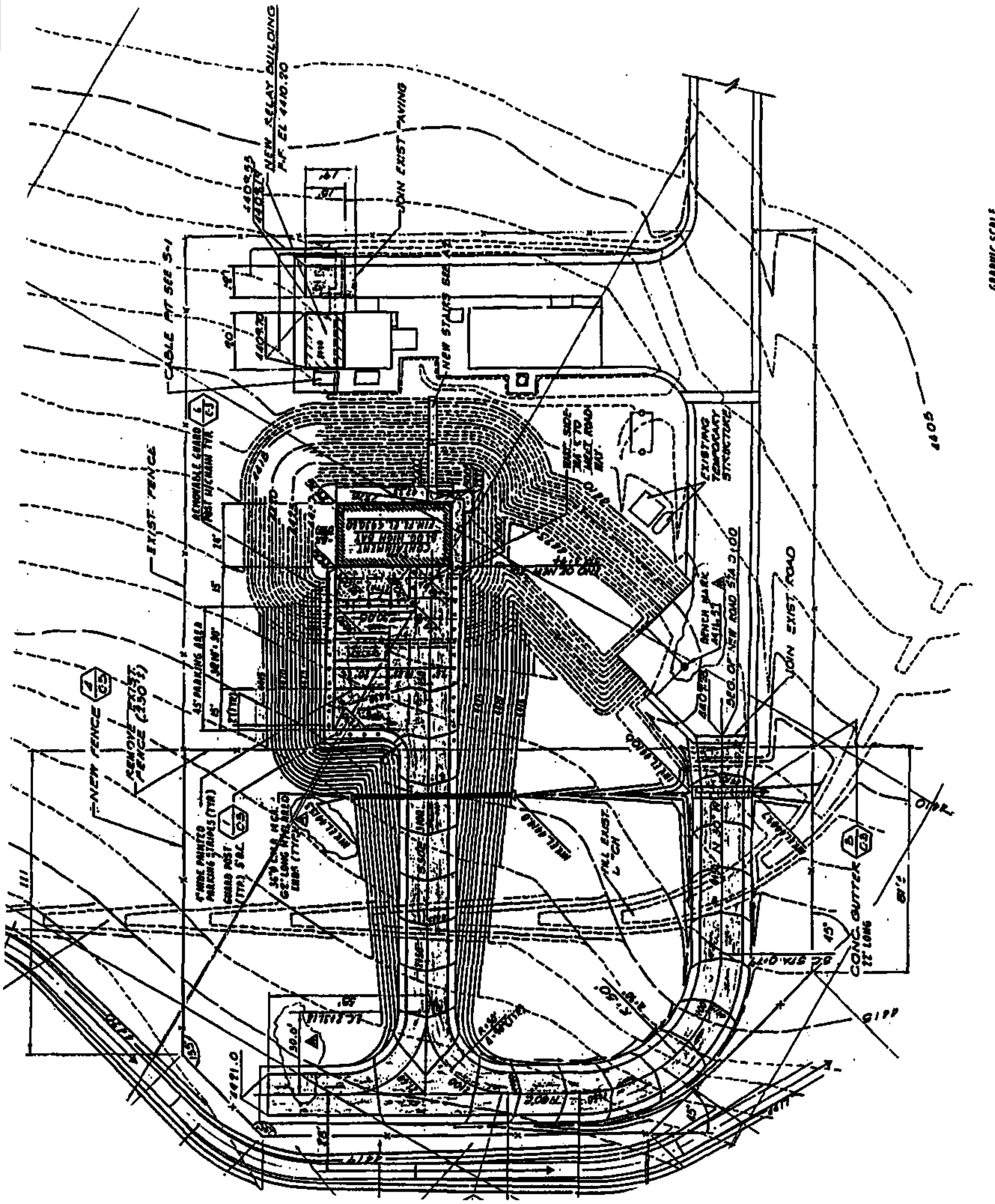

Figure 3. Plan map of the Super Kukla facility, ca. 1968.

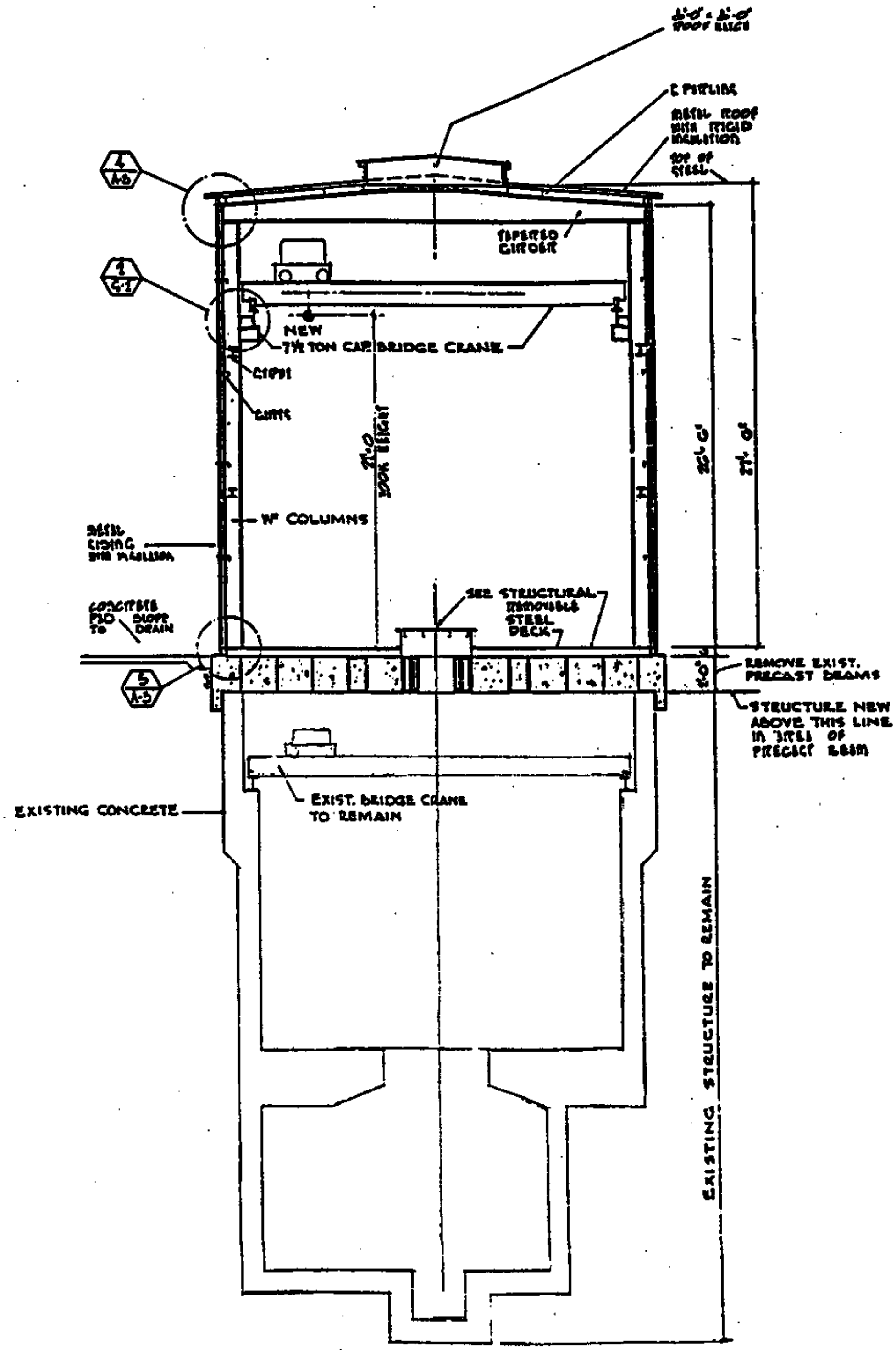

Figure 4. Section of the High Bay, Building 5400A, Super Kukla facility, ca. 1968.

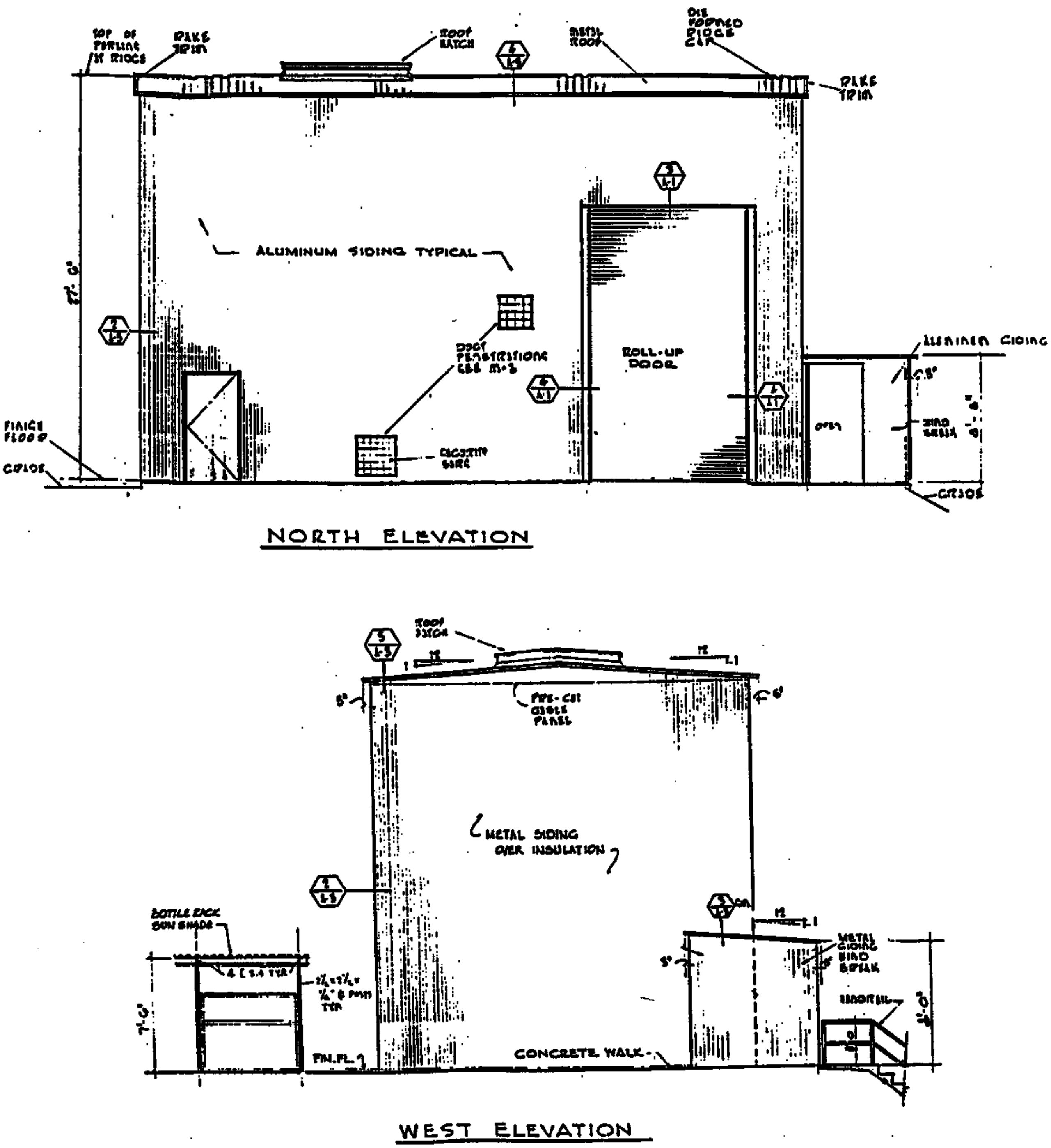

Figure 5. North and west elevations of the High Bay, Building 5400A, Super Kukla facility, ca. 1968.

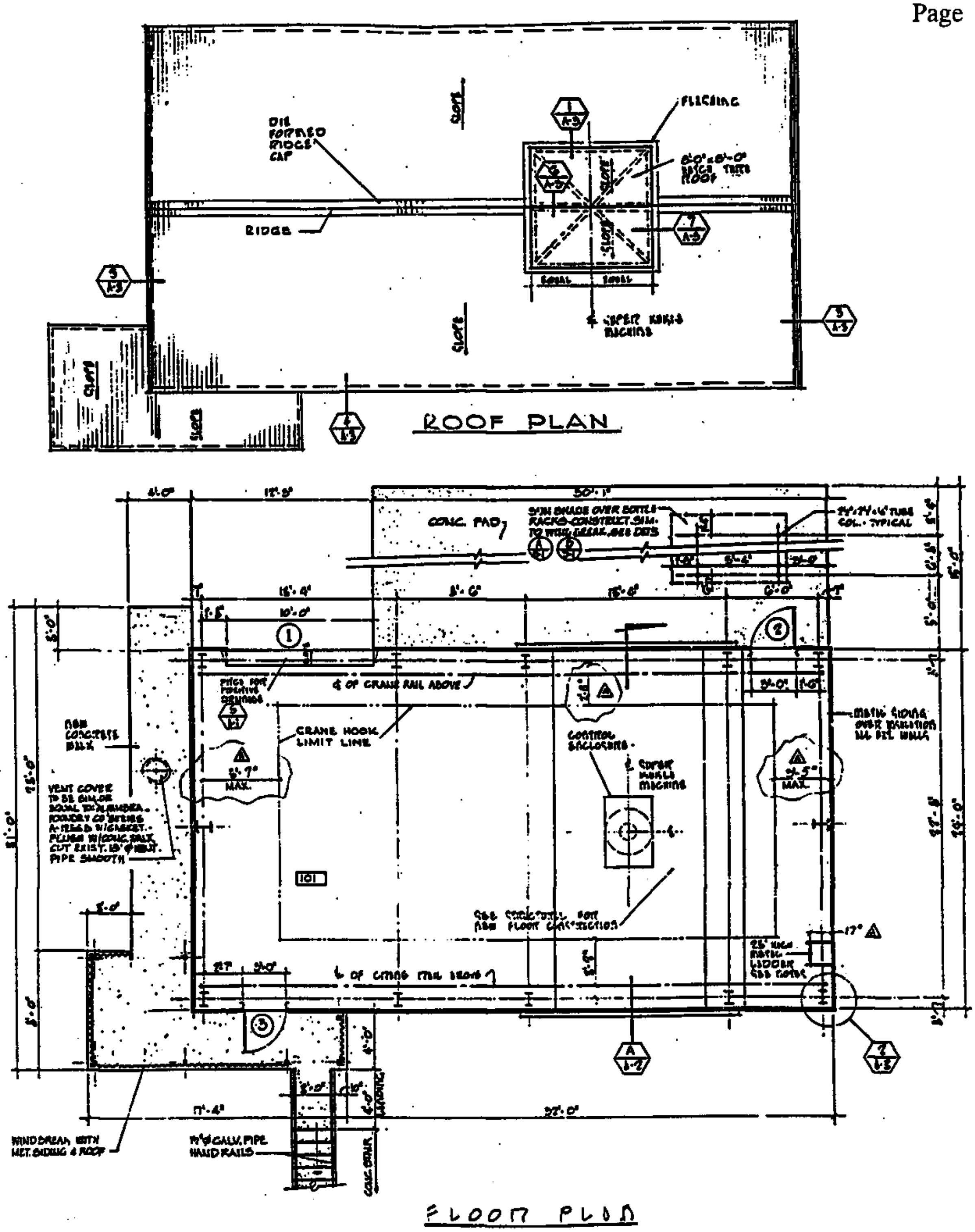

Figure 6. Roof and floor plans for the High Bay, Building 5400A, Super Kukla facility, ca. 1968.

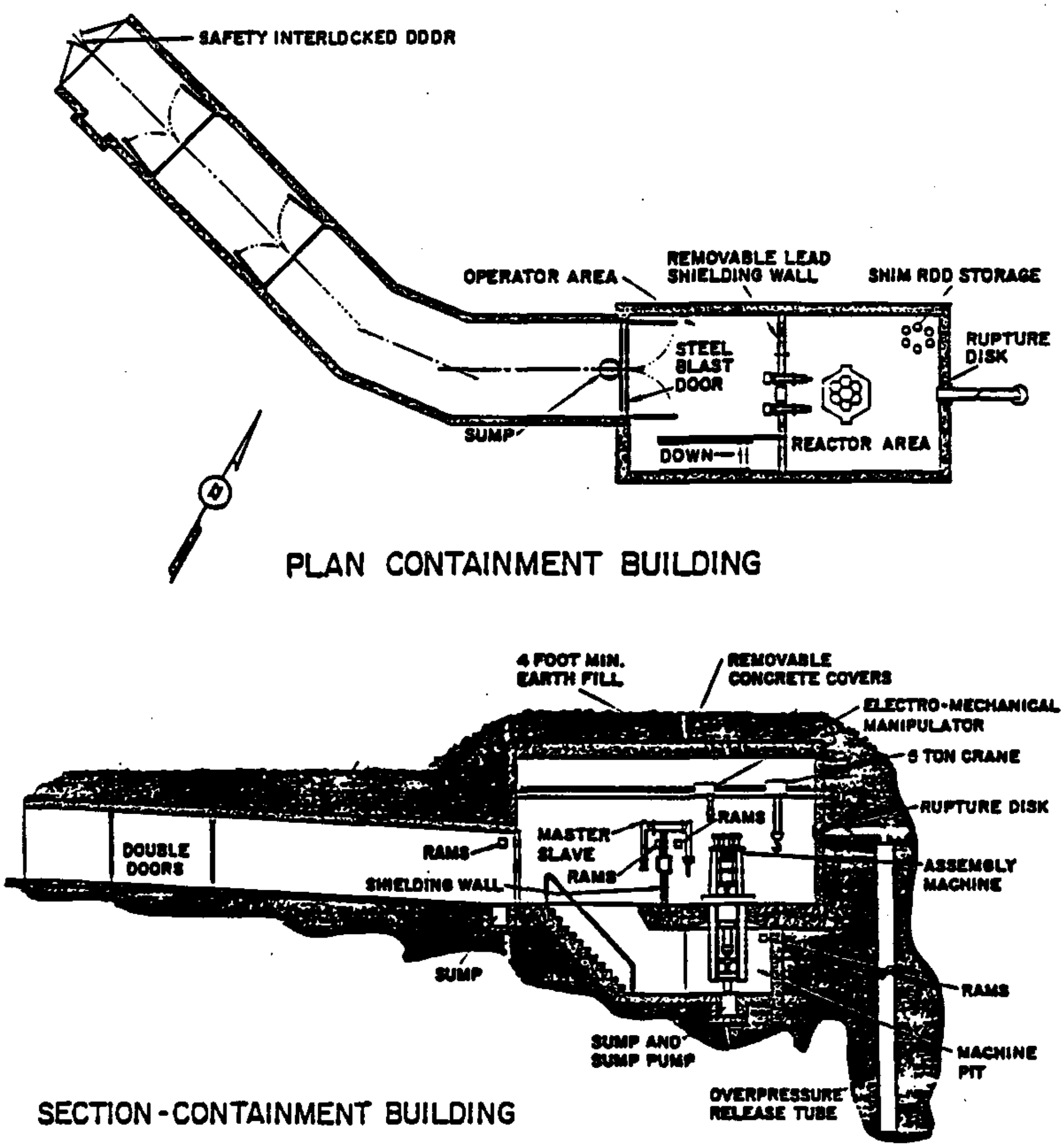

Figure 7. Plan and section of the Containment Building, Building 5400, Super Kukla facility ca. 1963.

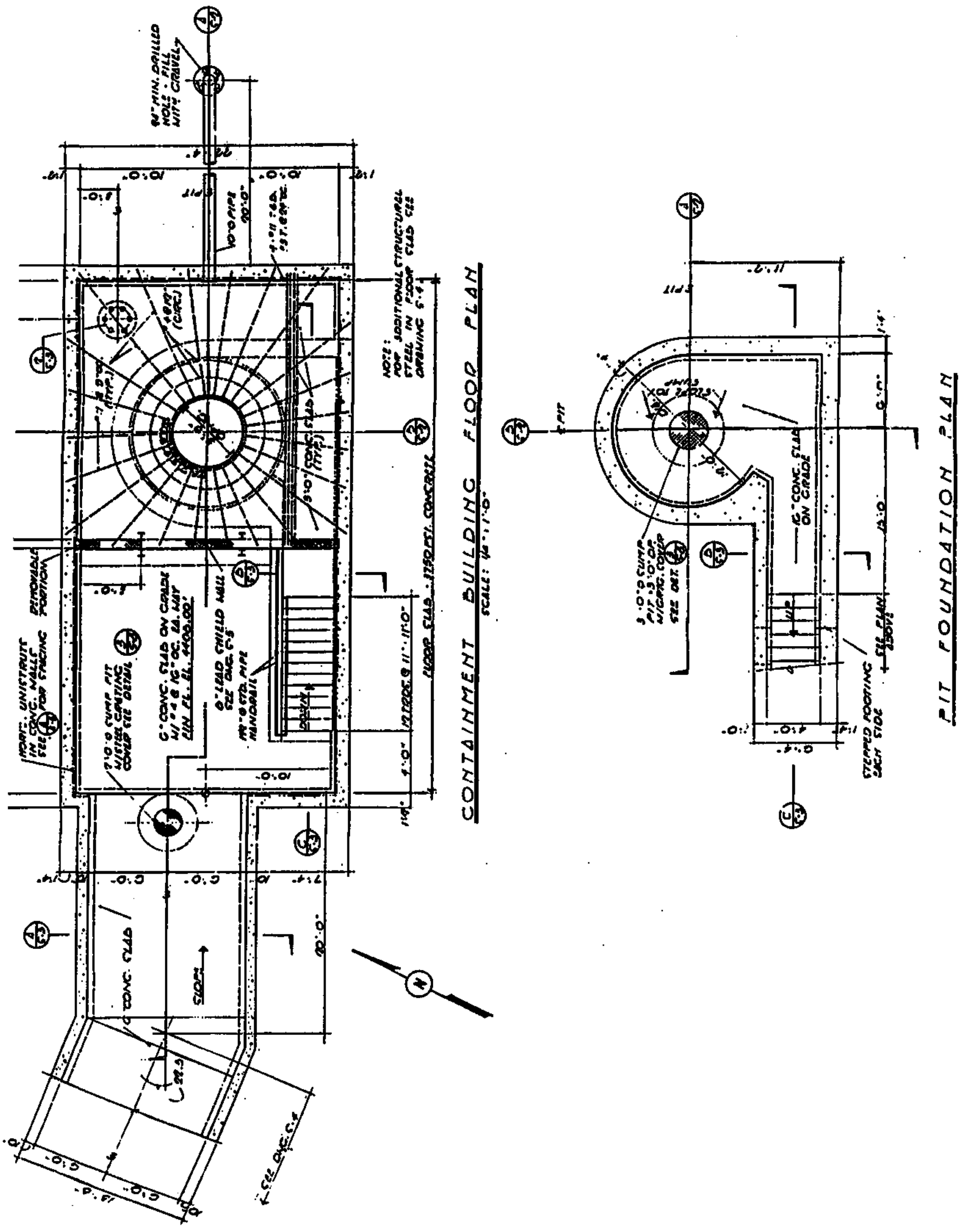

Figure 8. Floor plan of the Containment Building, Building 5400, Super Kukla facility, ca. 1963.